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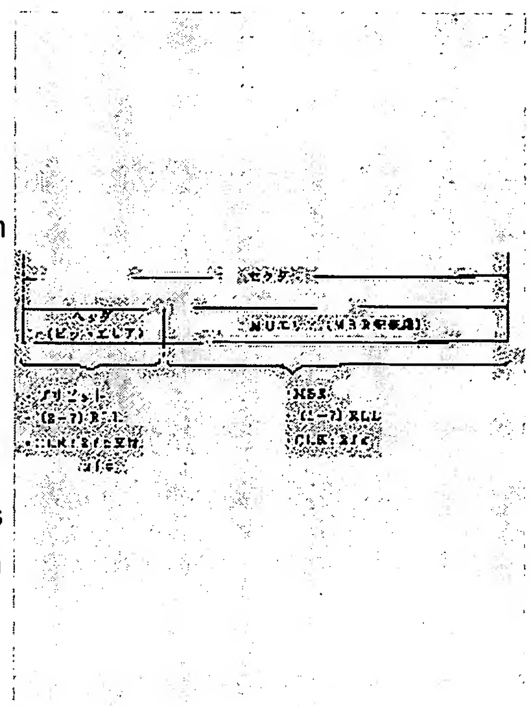
(54) RECORDING MEDIUM AND REPRODUCING APPARATUS



(57)Abstract:

PROBLEM TO BE SOLVED: To realize an appropriate large capacity concerning a recording medium by setting a data recording density in a header region and that in a recording and reproducing region at different values from each other.

SOLUTION: A header is a reproduction-dedicated region. In an MO area used as a region accepting magneto-optical recording/reproduction, user data or the like are recorded. As a data modulation method, a (1-7) run length limited code modulation method ('(1-7)RLL') is employed. The frequency of a reproduction clock DCK in the MO area is set, for example, at 2fc, where fc is a clock frequency in the case of an MO disk. On the other hand, in the header, a (2-7) run length limited code modulation method ('(2-7)RLL') is employed as the modulation method that is different from that employed in the MO area. In addition, a frequency of the reproduction clock DCK is set either at 2fc, which is the same as that in the MO area, or at αfc (where 1<α≤2) which is different from that in the MO area.

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CLAIMS

[Claim(s)]
[Claim 1] The record medium characterized by making the sector as a data unit on a record medium into the data-logging consistency in said header field, and the consistency from which the data-logging consistency in said record playback field differs while being formed of the header field where preformat data were recorded, and the record playback field in which record playback of data is possible.
[Claim 2] The record medium according to claim 1 which the data based on the 1st modulation technique are recorded in said header field, and is characterized by performing data logging by the 2nd modulation technique in which high density record is more possible than said 1st modulation technique in said record playback field.
[Claim 3] Said record playback field is a record medium according to claim 1 characterized by forming the record layer so that a magnetic super resolution playback system may become possible.
[Claim 4] It is the record medium according to claim 2 which said 1st modulation technique is a run length (2-7) Limited code modulation technique, and is characterized by said 2nd modulation technique being a run length (1-7) Limited code modulation technique.
[Claim 5] The data playback from said header field and the data playback from said record playback field are a record medium according to claim 1 characterized by performing data logging so that the clock of the same frequency can use and perform.
[Claim 6] While being formed of the header field where preformat data were recorded for the sector as a data unit on a record medium, and the record playback field in which record playback of data is possible In said header field, the data based on the 1st modulation technique are recorded. In said record playback field As a regenerative apparatus corresponding to the record medium with which data logging by the 2nd modulation technique in which high density record is more possible than said 1st modulation technique is performed The 1st decoding means corresponding to said 1st modulation technique, and the 2nd decoding means corresponding to said 2nd modulation technique, The means for switching which the information read from the record medium is alternatively supplied [means for switching] to said 1st decoding means and said 2nd decoding means, and performs decoding, The regenerative apparatus characterized by having the control means which controls change-over actuation of said means for switching by the timing equivalent to said header field, and timing equivalent to said record playback field.
[Claim 7] Said 1st decoding means is a regenerative apparatus according to claim 6 characterized by performing decoding corresponding to [perform decoding corresponding to a run length (2-7) Limited code modulation technique, and] a run length (1-7) Limited code modulation technique in said 2nd decoding means.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to record media, such as a magneto-optic disk, and the regenerative apparatus corresponding to it.
[0002]
[Description of the Prior Art] In record media, such as an optical disk, a magnetic disk, a magneto-optic disk, a magnetic tape, and an optical tape, densification has been one technical problem and various kinds of techniques for high density record playback are developed. For example, although the magneto-optic disk called an MO disk is mainly put in practical use for record playback of computer data, as compared with the thing of the 1st generation, as for the case of the MO disk (5.25 inch disk), about 8 times as many densification as this is progressing in the present condition.
[0003]
[Problem(s) to be Solved by the Invention] Here, although the further densification serves as a technical problem, it is very difficult from the engine performance of pickup of the present mass-production level, for example, the limitation of the diameter of a laser spot etc., to advance densification of the direction of a track pitch. Moreover, in order to hold compatibility with a low order disk, it is not appropriate to change the sector format on a disk sharply and to attain densification. Moreover, although raising a consistency in the bit density of a truck line, i.e., the direction, is also considered, interference between bits becomes large too much, and the densification beyond the present condition has become what also has this difficult.
[0004]
[Means for Solving the Problem] It aims at offering the regenerative apparatus corresponding to such a record medium, while realizing suitable large capacity-ization concerning [this invention] a record medium in view of such a trouble.
[0005] For this reason, as a record medium of this invention, it is made to consider as the data-logging consistency in a header field, and the consistency from which the data-logging consistency in a record playback field differs. For example, the data based on the 1st modulation technique are recorded, and it is made for data-logging consistencies to differ in a record playback field in a header field by data logging by the 2nd modulation technique in which high density record is more possible than the 1st modulation technique being performed. Moreover, a record playback field is that the record layer is formed so that a magnetic super resolution playback system may become possible, and it attains large capacity-ization. Moreover, the 1st modulation technique is a run length (2-7) Limited code modulation technique, and the 2nd modulation technique presupposes that it is a run length (1-7) Limited code modulation technique. Moreover, data logging is made to be performed so that the clock of the same frequency can use and perform data playback from a header field, and data playback from a record playback field.
[0006] The regenerative apparatus of this invention is equipped with the 1st decoding means corresponding to the 1st modulation technique, the 2nd decoding means corresponding to the 2nd

modulation technique, the means for switching that the information read from the record medium is alternatively supplied [means for switching] to the 1st decoding means and the 2nd decoding means, and performs decoding, and the control means which controls change-over actuation of a means for switching by the timing equivalent to a header field, and timing equivalent to a record playback field.
[0007] In recent years, the magnetic super resolution playback system (magnetic super resolution: MSR:Magnetically induced Super Resolution) is proposed as one of the techniques aiming at the densification of a magneto-optic disk. This MSR playback system is the technique which can read the recording information in a field smaller than a laser spot using the magnetic film with which the temperature characteristics differ. That is, even if the magnetic film with which such the temperature characteristics differ does not perform minor diameter-ization of the diameter of a laser spot to the media (MSR media) which have the record section made into the two-layer structure, the information by which high density record was carried out can be read.
[0008] For example, the storage capacity of a magneto-optic disk can be made to raise sharply by using this MSR method. However, the whole region of an MO disk cannot use a MSR method. As a fundamental data format on the disk, a data unit called a sector is adopted and the MO disk is formed for the sector of the header field where the preformat data based on an embossing pit were recorded, and the record playback field in which record playback of data is possible as an optical MAG field. It becomes a record playback field that the record film corresponding to a MSR method can be formed though natural in such an MO disk, and it cannot carry out a MSR method in a header field. By the configuration of the record medium of this invention described above to such a situation, and a regenerative apparatus, when improving recording density for example, with a MSR method, the data gestalt in a header field and a record playback field is devised, and a more suitable record medium and a more suitable regenerative apparatus are realized.
[0009]
[Embodiment of the Invention] Hereafter, the optical MAG (MO) disk and the record regenerative apparatus corresponding to it are explained as the record medium of this invention, and a gestalt of operation of a regenerative apparatus.
[0010] The disk of this example is explained first. In an MO disk, the unit of a sector in the data stream formed on the truck of a disk shall continue. And although one sector is later mentioned by drawing 3 about the example of a sector format, as shown in drawing 1 , it is divided roughly, and is divided into a header and MO area.
[0011] A header is the field only for playbacks where the data based on the so-called embossing pit were recorded, and the address etc. is recorded as mentioning later. User data and others are recorded as a field which MO area can reproduce [a magneto-optic recording/].
[0012] In this example, MO area is made into the field in which MSR record film was formed here, namely, data are reproduced with a MSR playback system. Therefore, a data-logging consistency can realize a twice [about] as many consistency as this rather than an old MO disk (for example, dense 8 time disk). Moreover, as a modulation technique of data, a run length (1-7) Limited code modulation technique (henceforth "RLL (1-7)") shall be adopted. Since recording density becomes twice [about] an old MO disk, the frequency of the playback clock DCK turns into a twice [about] as many frequency as this as compared with the case of an MO disk old [the]. For example, the frequency of the playback clock DCK in MO area of this example presupposes that they are 2fc(s) by setting the clock frequency in the case of an old MO disk to fc.
[0013] On the other hand, although data are recorded by the pit preformatted as mentioned above in the header, a run length Limited code modulation technique (henceforth "RLL (2-7)") shall be adopted as a data modulation technique different here from MO area (2-7). Moreover, the frequency of the playback clock DCK presupposes that it is alphafc higher than the old frequency fc although the same 2fc(s) as MO area differ from MO area (however, 1< alpha<=2).
[0014] That is, the MO disk of this example has the description of MSR playback being performed in MO area, being that from which the modulation technique of data differs by RLL (1-7) and RLL (2-7) in MO area and a header, and becoming that from which recording density differs by them. Furthermore,

about the playback clock DCK, there are an example made into the same frequency by MO area and the header and an example made into a different frequency.
[0015] In addition, the frequency of the playback clock DCK in MO area is not restricted to 2fc(s). Here, by using a MSR method, it is referred to as "2fc" as an example that no less than two double densities become possible. And alphafc of the clock frequency in a header is the same as that of MO area, or it is used for the purpose of being a low frequency somewhat rather than MO area with it.
[0016] The basis and effectiveness of the following and MSR playback system, the sector format, and the configuration of the above-mentioned MO disk about such an MO disk of this example are described.
[0017] Drawing 2 explains a MSR (magnetic super resolution) playback system. A recording track Dt and the laser beam spot Bs irradiated on it are shown in drawing 2 (a), and drawing 2 (b) shows a part of cross section of a magneto-optic disk. In order to acquire the effectiveness of MSR, as shown in drawing 2 (b), it is necessary to have the record layer from which a magneto-optic disk serves as a layer from which magnetic properties differ with temperature, respectively, and a playback layer. A playback layer is a layer which carries out mask Ms of the record layer from the beam spot Bs of a laser beam Lb. And a small aperture (aperture Ap) is formed on the playback layer concerned by irradiating the laser power for playback at this playback layer, and the sense mt of magnetization of the record bit Rb of the record layer which is a lower layer is imprinted by this aperture Ap so that drawing 2 (a) and (b) may show. By observing the sense mt of the magnetization imprinted by the playback layer, the record bit Rb recorded on high density also by the big laser beam Lb of the diameter of a spot can be read.
[0018] Thus, although the sense mt of magnetization will be imprinted by the playback layer from a record layer by irradiating the laser beam Lb of the laser power for playback, since the area in which an imprint is performed in a playback layer, the magnitude, i.e., the record layer, of Aperture Ap, is controllable by the playback laser power at that time, if playback laser power controls well, it will become possible to develop the frequency characteristics of the signal reproduced from a disk. If such a MSR technique is used, even if it is the same diameter of the beam spot as the former, high density record playback of more than twice will be attained, for example. And in the disk of this example, record playback with such a MSR method shall be performed in MO area of drawing 1 .
[0019] Next, drawing 3 explains a concrete sector format. User data are recorded on a magneto-optic disk considering a sector as a unit of record/playback. As shown in drawing 3 (a), 1 sector is classified into a header, the TORAJISHON area TA 1, an ALPC gap, VF03, a sink, a data field, a postamble PA 2, a buffer, and the TORAJISHON area TA 2 according to the order of record/playback. In addition, the figure attached all over drawing expresses a byte count.
[0020] Such 1 sector is roughly divided, address part (namely, header) and data division are prepared, and an ALPC gap and the TORAJISHON area TA1 and TA2 are arranged before and behind data division. A header is the field only for playbacks where the so-called embossing pit was preformatted and recorded, and the section to the TORAJISHON area TA 2 serves as MO area from the TORAJISHON area TA 1 except a header. In this MO area, the MSR effectiveness explained by drawing 2 can be acquired.
[0021] Drawing 3 (b) expands and shows DDA to 64 bytes of that as address part. It passes and DDA is considered as the configuration with which VFO2 (16 bytes) of VFO1 (26 bytes) of a sector mark SM (8 bytes) and the VFO field, the address mark AM 1 (1 byte), ID1 (5 bytes) of an ID field, and the VF0 field, the address mark AM 2 (1 byte), ID2 (5 bytes) of an ID field, and a postamble PA 1 (1 byte) were arranged in order.
[0022] A sector mark SM is a mark for identifying initiation of a sector, and the pattern which is not produced in a RLL (1-7) sign or (2-7) a RLL sign is formed of embossing. The VFO field in one sector is for synchronizing VF0 (Variable Frequency Oscillator) in the PLL section of the record regenerative apparatus mentioned later, and consists of VFO1, VFO2, and VF03. That is, these serve as a PLL lead-in field. And VFO1 and VFO2 are formed in address part of embossing. In addition, VF03 is formed in data division, as shown in drawing 3 (a), and in case record actuation is performed to the sector, it is recorded on an optical MAG target.

[0023] In VFO1 and VFO2, the signal of the predetermined pattern for performing an aiming at read-out PLL [data / (address) / in the header by which data logging is carried out by the RLL (2-7) method] lead-in (generation of a playback clock) is recorded. On the other hand by VFO3, the signal of the predetermined pattern for performing an aiming at read-out PLL [data / (address) / in the header by which data logging is carried out by the RLL (1-7) method] lead-in (generation of a playback clock) is recorded. For example, VF03 has the pattern (2T pattern) with which '0' of a channel bit and '1' appear by turns, respectively. Therefore, when time amount corresponding to the time amount length of an one-channel bit was set to T and the VFO field is reproduced, the regenerative signal which level reverses to every 2T is acquired.
[0024] The address mark AM is used in order to give the cutting tool synchronization for a consecutive ID field to equipment, and it has a predetermined pattern. An ID field has a CRC cutting tool for error detection to the information on the address of a sector, i.e., a track number, and a sector number, and such information. Although 5 bytes of each ID fields ID1 and ID2 serve as address information of a sector, let these be the same data. That is, in one sector, the address is being recorded twice.
[0025] The postamble PA 1 in a header and PA2 in data division have a predetermined pattern, respectively.
[0026] In drawing 2 (a), the ALPC gap area allotted through the TORAJISHON area TA 1 following a header is prepared for the test of reservation of the time amount which the processing after completing the read of a header takes to equipment, permission of a gap of the next location of VF03, and the laser power at the time of record etc.
[0027] Moreover, although data division consist of VFO3, the sink field, a data field, a postamble PA 2, and the buffer field like drawing 2 (a), the sink field (4 bytes) is prepared in order that equipment may obtain the cutting tool synchronization for the continuing data field, and has a predetermined bit pattern.
[0028] A data field is prepared in order to record user data. 2048 bytes is secured as user data, and it is that error detection, the parity for correction, etc. are recorded in addition to it, and becomes 2498 bytes. In addition, although not illustrated, the RISHINKU pattern for the synchronization with a position is arranged on the data field. The buffer field is used as tolerance to an electric or mechanical error.
[0029] By such disk of this example, as drawing 1 explained, it has the description of MSR playback being performed in MO area, being that from which the modulation technique of data differs by RLL (1-7) and RLL (2-7) in MO area and a header, and becoming that from which recording density differs by them. About the playback clock DCK, there are an example made into the same frequency by MO area and the header and an example made into a different frequency. When the playback clock DCK is first made into a frequency which is different by MO area and the header, drawing 4 explains the basis and effectiveness of the configuration of an MO disk of about.
[0030] Drawing 4 (a) shows the present dense 8 time MO disk, and drawing 4 (d) shows the description of the MO disk of this example. First, like drawing 4 (a), by the dense 8 time disk, a modulation technique is set to RLL (1-7), and recording density is similarly treated the same for it by both the header and MO area. Therefore, the frequency of the playback clock DCK also becomes the same, and sets the frequency to fc temporarily.
[0031] If the further improvement in recording density (storage capacity rise) is considered from such a dense disk 8 times, it is possible to adopt the above-mentioned MSR technique. However, if a large change of a sector format is made a not desirable thing in consideration of points, such as compatibility, since the MSR effectiveness is not acquired in a header, although a MSR method is adopted in MO area, a header will be called as [old] like drawing 4 (b). In this case, densification of two double densities (that is, 16 times denser) is realized by the MSR effectiveness [drawing 4 (a)] in MO area. however, since a header is still old, the rise of the storage capacity as an entire disk will boil it by the loss in a header, and it will be restricted.
[0032] It is there, next considers making the whole capacity raise by carrying out densification also of the header. For this reason, recording density is packed to the condition that the frequency of the playback clock DCK serves as alphafc, like drawing 4 (c). That is, densification of a certain extent is performed as possible within the limits with the present diameter of a laser spot. That a clock frequency

becomes high and the minimum repeat frequency goes up although the minimum reversal spacing in RLL (1-7) is 2T here means that this time amount width of face of 2T becomes quite small, and the margin of a reversion system becomes small too much. That is, good playback becomes difficult.
[0033] The difference in the recording density of RLL (1-7) and RLL (2-7) is shown in drawing 6 here. That is, as data recorded on a disk, when a part for 1 byte of the same data is modulated, as shown in drawing 6 (1-7), recording density differs by RLL and RLL (2-7). That is, (1-7), the direction of RLL serves as high density. Moreover (1-7), the minimum reversal spacing of 2T and RLL (2-7) is set to 3T by the minimum reversal spacing of RLL.
[0034] Since it becomes impossible to take the margin of a reversion system good in the case of drawing 4 (c), in drawing 4 (d) showing the disk of this example, a RLL (2-7) method shall be adopted at the sacrifice of the improvement in recording density of some. In this case, since the minimum reversal spacing is 3T also as playback clock frequency =alphafc, the minimum repeat frequency can fall, and sufficient playback margin can be obtained. However, since the sacrifice of the storage capacity by adopting a RLL (2-7) method is not so big, by the disk of this example, sufficient playback margin can be obtained with large densification.
[0035] Next, the example of this invention is considered from a viewpoint of wanting to make a playback clock frequency the same in a header and MO area. Drawing 5 explains this.
[0036] Drawing 5 (a) shows the present dense 8 time MO disk same with drawing 4 (a), and drawing 5 (c) shows the description of the MO disk of this example. First, like drawing 5 (a), by the dense 8 time disk, a modulation technique is set to RLL (1-7), and recording density is similarly treated the same for it by both the header and MO area. Therefore, the frequency of the playback clock DCK also serves as the same fc.
[0037] While the further improvement in recording density (storage capacity rise) is considered from such a dense disk 8 times and adopting the above-mentioned MSR technique thinks, it considers that recording density of a header and MO area tends to be made the same, and it is going to make a playback clock frequency the same. Then, densification of two double densities (that is, 16 times denser) will be realized by the MSR effectiveness like [in MO area] drawing 5 (b), and a pit will be formed in it by 2 in all double densities also by the header.
[0038] However, since the MSR effectiveness is not acquired in a header, such densification is impossible practically. That is, a suitable playback margin is not obtained. So, in drawing 5 (c) showing the disk of this example, a RLL (2-7) method shall be adopted at the sacrifice of the improvement in recording density of some. Then, since it is the same as MO area, for example, the minimum reversal spacing is set to 3T also as 2fc(s) in a playback clock frequency in this case, the minimum repeat frequency can fall, and sufficient playback margin can be obtained.
[0039] That is, the thing for which MSR playback is performed by the disk of this example in MO area, It is that from which the modulation technique of data differs by RLL (1-7) and RLL (2-7) in MO area and a header, And although the example which has the description of becoming that from which recording density differs, and is further made the same frequency by them by MO area and the header about the playback clock DCK, and the example made into a different frequency can be considered By such disk of this example, while realizing remarkable densification, good reproducibility ability is maintainable.
[0040] In addition, even when playback clock frequencies differ somewhat in a header and MO area, since it is VFO1 or VFO2 and a PLL lead-in is performed by VFO3 about MO area about a header, it is satisfactory. However, it may be necessary to switch the multiplier of PLL circles of a regenerative apparatus depending on extent of the difference of a clock frequency. On the other hand, the same, then such a multiplier change-over are also unnecessary in a clock frequency. It should just be determined in consideration of various design situations whether to make a clock frequency the same or consider as a different thing.
[0041] Then, the configuration and actuation of a record regenerative apparatus corresponding to the above disks of this example are explained.
[0042] Although the bit BAIBITTO decoding method and a Viterbi decoding method are used in the RF

signal regeneration system as a regenerative apparatus of a magneto-optic disk, the record regenerative apparatus of this example is used as the record regenerative apparatus which has the reversion system which performs Viterbi decoding, and shows the block diagram of the record reversion system to drawing 7 . Moreover, the configuration of the drive controller 2 in drawing 7 is shown in drawing 8 . In addition, the block diagram of drawing 7 mainly shows only the processor of a record regenerative signal, and servo system and others are omitted.
[0043] A magneto-optic disk 6 is in the condition by which the rotation drive was carried out with the spindle motor 9 into the record regenerative apparatus, and informational record, playback, and elimination are performed by actuation of an optical pickup 7 and the magnetic head 5. The rotation servo of a spindle motor 9 will be further performed by the optical pickup 7 at the time of record, playback, and elimination and the position control (seeking, a tracking servo, thread servo) of the magnetic head 5, the focus servo of the laser beam from an optical pickup 7, and the servo system that is not illustrated.
[0044] Let the drive controller (henceforth a controller) 2 be the part which performs the communication link with a host computer 1 while it performs various kinds of motion control as a master controller of this record regenerative apparatus. That is, a controller 2 controls actuation which reads the data similarly demanded according to the directions from a host computer 1 from a disk 6, and is transmitted to a host computer 1 while controlling the actuation which records the supplied data on a disk 6 according to the record directions from a host computer 1. Moreover, the controller 2 also has the function to perform encoding of data, and decoding. The detailed configuration of a controller 2 is later mentioned by drawing 8 .
[0045] Let CPU3 be the part which controls each part based on directions of a controller 2 for record playback actuation.
[0046] At the time of record, a controller 2 encodes the user data which should be recorded based on a receipt and the user data as an information word according to the command of a host computer 1, and generates the RLL (1 7) sign as a symbolic language. This symbolic language is supplied to the laser power control section (it is hereafter written as LPC) 4 as record data WDATA. Moreover, a controller 2 directs the luminescence actuation and its timing as a recording mode to LPC4 as a WGATE signal.
[0047] At the time of playback, at the time of record, LPC4 generates a laser drive current so that the laser output from an optical pickup 7 may be performed in each at the time of elimination. In addition, according to directions of CPU3, it is set up at the time of record at the time of playback, the laser luminescence level in each, i.e., the laser drive current value, at the time of elimination. When record is directed by the WGATE signal, LPC4 records by forming the pit train which controls the laser power of an optical pickup 7 and has magnetic polarity on a magneto-optic disk 6 corresponding to the supplied record data WDATA. In the case of this record, the magnetic head 5 gives a bias field to a magneto-optic disk 6.
[0048] The following actuation is performed by control of a controller 2 and CPU3 at the time of playback.
[0049] A controller 2 supplies a RGATE signal and an IDGATE signal to LPC4 and the RF block 20, and performs playback motion control. That is, with a RGATE signal, a controller 2 directs regeneration to the RF block 20 while directing continuation luminescence by the laser power as a regeneration level to LPC4. Moreover, although a header (address part) and data division exist as a sector format of a disk 6 as mentioned above, an IDGATE signal becomes what directs the timing of operation in each field, and actuation of LPC4 and the RF block 20 is performed according to this. For example, an IDGATE signal is outputted as a signal like drawing 9 by the controller 2.
[0050] First, LPC4 generates a laser drive current according to a RGATE signal at the time of playback, and performs the laser output for playback actuation from an optical pickup 7 at it. An optical pickup 7 irradiates a laser beam at a magneto-optic disk 6, and receives the reflected light produced by it. Furthermore, data processing of the signal according to the amount of reflected lights generates various signals. That is, they are sum signal R+, difference signal R- and the focal error signal that is not illustrated, a tracking error signal, etc. In addition, information reading from the data division in MO

area will be performed by the MSR playback system mentioned above.
[0051] Sum signal R+ is supplied to a changeover switch 10, after a gain adjustment etc. is made by amplifier 8a. Moreover, difference signal R- is supplied to a changeover switch 10, after a gain adjustment etc. is made by amplifier 8b. Gain setting in Amplifier 8a and 8b is performed by CPU3. In addition, a focal error signal and a tracking error signal are supplied to the servo system which is not illustrated, and are used for servo control.
[0052] According to an IDGATE signal, change actuation is performed in a changeover switch 10, and sum signal R+ or difference signal R- is supplied to the filter section 11. That is, in the sector format of the magneto-optic disk 6 mentioned later, the signal reproduced from the address part formed of embossing supplies sum signal R+ to the filter section 11 at the period supplied to a changeover switch 10. Moreover, the signal reproduced by the MSR method supplies difference signal R- to the filter section 11 from the data division by which record is performed on the optical MAG target at the period supplied to a changeover switch 10.
[0053] The filter section 11 consists of waveform equalizers which perform the low pass filter and waveform equalization which perform a noise cut. And equalizing of the inputted signal is carried out so that the partial response property which suits the Viterbi decoding approach which the Viterbi decoder 13 performs may be acquired. A/D converter 12 performs A/D conversion for the output of the filter section 11 according to the playback clock DCK, and outputs regenerative-signal value z [k]. The Viterbi decoder 13 generates the decode data DD by the Viterbi decoding approach based on regenerative-signal value z [k]. These decode data DD are a maximum-likelihood-decoding sequence over record data. Therefore, when there is no decode error, the decode data DD are in agreement with record data.
[0054] The decode data DD are supplied to a controller 2. As mentioned above, record data are the symbolic language generated by coding of channel coding etc. from user data. Therefore, if a decode error rate is low enough, it can be considered that the decode data DD are record data as a symbolic language. A controller 2 reproduces user data etc. by performing decryption processing corresponding to coding of above-mentioned channel coding etc. to the decode data DD. Specifically to the data (data concerning sum signal R+) from a header, decoding of a RLL (1-7) method is performed to the data (data concerning difference signal R-) from decoding of a RLL (2-7) method, or data division.
[0055] The playback clock DCK for such regeneration is generated by the PLL section 14. That is, the output of the filter section 11 is supplied also to the PLL section 14, and the PLL section 14 generates the playback clock DCK by PLL actuation to the supplied signal. The playback clock DCK is supplied to a controller 2, A/D converter 12, and Viterbi decoder 13 grade, and actuation of these parts is performed to the timing according to the playback clock DCK.
[0056] A controller 2 has a control section 31, the interface section 32, a data buffer 33, the buffer controller 34, a decoder (1-7) 35, a decoder (2-7) 36, switches 37 and 38, and an encoder 39, as shown in drawing 8 .
[0057] the part where a control section 31 performs control processing as a controller 2 -- it is -- moreover -- therefore, it also has a function as a timing generator. The playback clock DCK generated in the PLL section 14 is supplied to a control section 31, and a control section 32 generates the signal which controls the timing of equipments, such as a change of record/playback actuation, of operation using the playback clock DCK. That is, an IDGATE signal, a RGATE signal, and a WGATE signal are generated. Moreover, a control section 31 will give the required directions for record playback actuation to each part of controller 2 inside and outside.
[0058] Let the interface section 32 be the part which performs transmission and reception with a host computer 1. That is, record demand from a host computer 1 of a control section 31, playback demand, and reception of record data are performed through the interface section 2. Moreover, transmission of the playback data to a host computer is performed by directions of a control section 31 through the interface section 2.
[0059] A data buffer 33 is memory which stores record data and playback data temporarily. Store to a data buffer 33 and read-out are performed by the buffer controller 34. An encoder 39 modulates the

record data incorporated by the data buffer 33, and uses them as the record data WDATA.
[0060] That is, when there is a record demand from a host computer, a control section 31 makes the record data transmitted first store in a data buffer 33 by the buffer controller 34. And record actuation directions are performed to CPU3, LPC4, and the servo system that is not illustrated, and necessary seeking processing is performed. And in case record is started, the record data stored in the data buffer 33 will be made to transmit to an encoder 39, error correction sign processing, RLL (1-7) encoding processing, etc. will be performed with an encoder 39, and LPC4 will be supplied as record data WDATA as above-mentioned.
[0061] (1-7) A decoder 35 and a decoder (2-7) 36 perform decoding to the decode data DD supplied at the time of playback. Moreover, the playback clock DCK is supplied for this decoding. Switches 37 and 38 are switched for example, by the IDGATE signal.
[0062] A control section 31 makes the optical pickup 7 to the sector of the demanded data seek first as actuation at the time of playback, in order to reproduce the data demanded from the host computer 1. And when checking whether the target sector has been become and becoming the target sector, reading a sector address, reading actuation is made to start the data of the data division of the sector.
[0063] In such a series of playback actuation, read-out of the address recorded on the ID field for checking the address of a sector will be performed, and read-out of the data recorded on the data field after that will be performed.
[0064] The signal with which the decode data DD were supplied to the decoder (2-7) 36, and the period when the data read from the header of a sector are supplied was decoded (2-7) is supplied to a control section 31 through the buffer controller 34 by the switches 37 and 38 switched by the IDGATE signal. That is, address data etc. will be incorporated.
[0065] On the other hand, the signal with which the decode data DD were supplied to the decoder (1-7) 35, and the period when the data read from the data division of a sector are supplied was decoded (1-7) is stored in the data buffer 33 through the buffer controller 34 by switches 37 and 38. And based on the directions from a control section 31, it is transmitted to a host computer 1 from the interface section 32 at the predetermined time.
[0066] Namely, decoding is carried out to playback (2-7) of the header of a sector, and, as for this record regenerative apparatus, decoding is carried out to playback (1-7) of data division. Therefore, to the disk of this example as shown in drawing 1 , it can reproduce appropriately and large capacity-ization of the disk of this example mentioned above can be supported.
[0067] In addition, the configuration of the above disk and a record regenerative apparatus is an example, and can consider examples various as this invention. Especially the technique for densification is not limited to a MSR method. Moreover (1-7), although considered as the example which uses together RLL and RLL (2-7), modulation techniques other than this may be used. Of course, the decoder which corresponds by the record regenerative-apparatus side in that case will be allotted. Moreover, although the record regenerative apparatus corresponding to a magneto-optic disk explained, this invention can also apply the regenerative apparatus corresponding to other record media.
[0068]
[Effect of the Invention] As explained above, be made to let the record media of this invention be a data-logging consistency in a header field, and the consistency from which the data-logging consistency in a record playback field differs. That is, a MSR method etc. can be adopted, for example about the data storage area as an optical MAG field, densification can be achieved, and remarkable large capacity-ization can be realized. Moreover, the data based on the 1st modulation technique are recorded, and when the recording density in a header field is packed in accordance with the densification in a record playback field by performing data logging by the 2nd modulation technique in which high density record is more possible than the 1st modulation technique, the margin in a data reversion system is induced and it can avoid checking suitable regeneration in a record playback field in a header field. Moreover, not only a record playback field but densification of a header field can be realized by this, and large capacity-ization as the whole record medium is attained.
[0069] Moreover, a header field is supposing that a RLL (2-7) modulation technique and a record

playback field are RLL (1-7) modulation techniques, and becomes suitable to obtain densification and the above-mentioned playback margin. For example, if both a header field and a record playback field compare supposing a record medium (that is, record medium which serves as large capacity most when it thinks also in a header field, having assumed that the MSR effectiveness was acquired) which a MSR method is used, and (1-7) is made into a RLL modulation technique, the storage capacity of the record medium of this invention can be stopped by several% of loss compared with such a record medium. If this stands on the premise that the MSR effectiveness is not acquired to a header field like this invention and it thinks, it will become what has realized most efficient large capacity-ization.
[0070] Moreover, clock processing with a regenerative apparatus can make data playback from a header field, and data playback from a record playback field easy and the stable thing by data logging being performed so that the clock of the same frequency can use and perform.
[0071] The regenerative apparatus of this invention switches a means for switching to the timing equivalent to a header field, and the timing equivalent to a record playback field, and the decoding actuation by the 1st decoding means corresponding to the 1st modulation technique and the decoding actuation by the 2nd decoding means corresponding to the 2nd modulation technique are made to be performed. That is, suitable playback actuation can be performed corresponding to the record medium of this invention. Moreover, a record medium is that they perform decoding corresponding to a RLL (2-7) modulation technique in the 1st decoding means, and perform decoding corresponding to a RLL (1-7) modulation technique in the 2nd decoding means when data logging of a RLL (2-7) modulation technique and the record playback field is carried out by the RLL (1-7) modulation technique, and, as for a header field, the optimal playback actuation of it is attained.
[0072] And the record medium and regenerative apparatus of this invention will become the optimal from the above thing on each point of improvement in recording density, and maintenance of playback dependability, when it leaves for the premise of being formed of the header field where preformat data were recorded for the sector as a data unit on a record medium, and the record playback field in which record playback of data is possible.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view of the disk of the gestalt of operation of this invention.
[Drawing 2] It is the explanatory view of MSR in the disk of the gestalt of operation.
[Drawing 3] It is the explanatory view of a sector format of the disk of the gestalt of operation.
[Drawing 4] It is the explanatory view of the basis about the description of the disk of the gestalt of operation.
[Drawing 5] It is the explanatory view of the basis about the description of the disk of the gestalt of operation.
[Drawing 6] (1-7) It is the explanatory view of the data density of RLL and RLL (2-7).
[Drawing 7] It is the block diagram of the record regenerative apparatus of the gestalt of operation of this invention.
[Drawing 8] It is the block diagram of the drive controller of the record regenerative apparatus of the gestalt of operation.
[Drawing 9] It is the IDGATE signal-description Fig. of the record regenerative apparatus of the gestalt of operation.
[Description of Notations]
1 Host Computer, 2 Drive Controller, 3 CPU, 4 The laser power control section, 5 The magnetic head, 6 Disk, 7 An optical pickup, 8 Amplifier, 9 A spindle motor, 10 Changeover switch, 11 The filter section, 12 An A/D converter, 13 Viterbi decoder, 14 The PLL section, 31 A control section, 32 The interface section, 33 A data buffer, 34 A buffer controller, 35 (1-7) A decoder, 36 (2-7) 37 A decoder, 38 A switch, 39 Encoder

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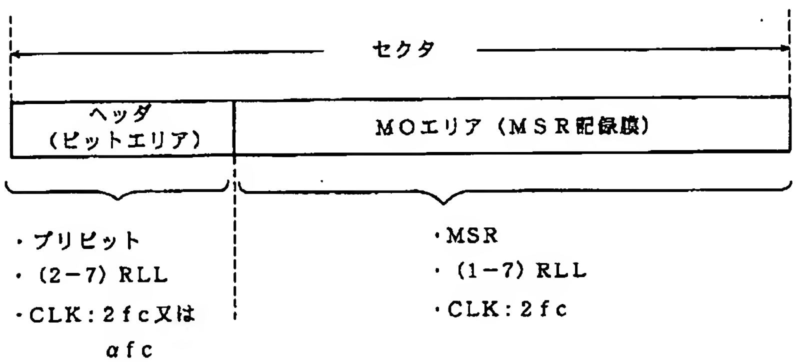
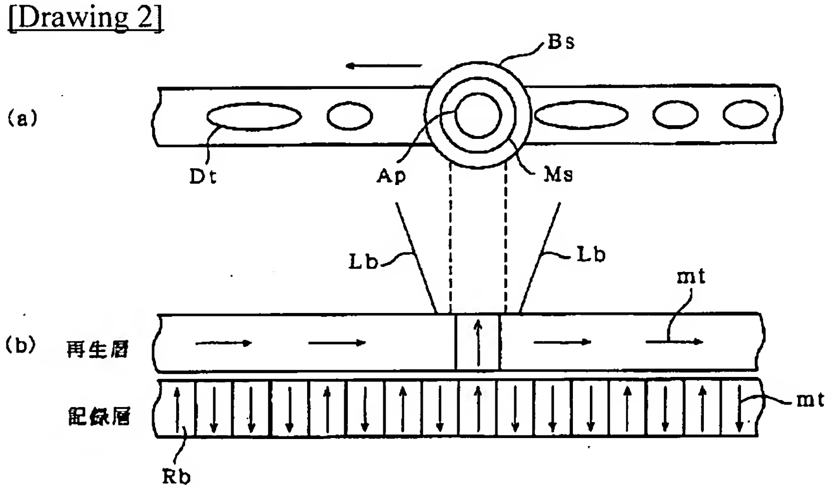
[Translation done.]

DRAWINGS

[Drawing 1]



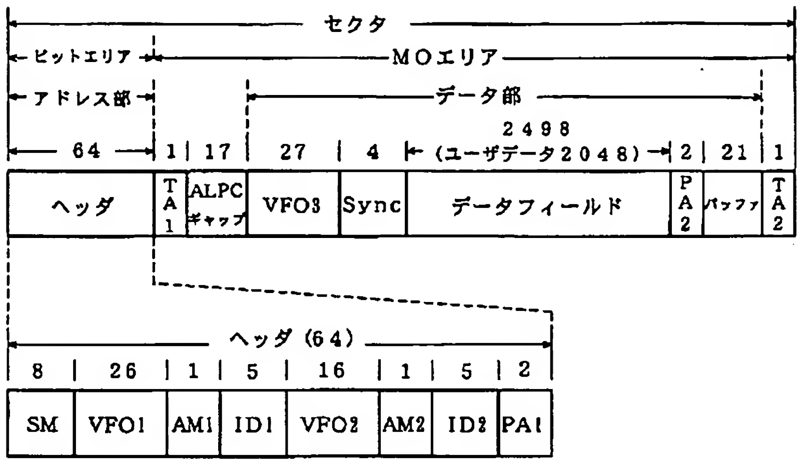
[Drawing 2]



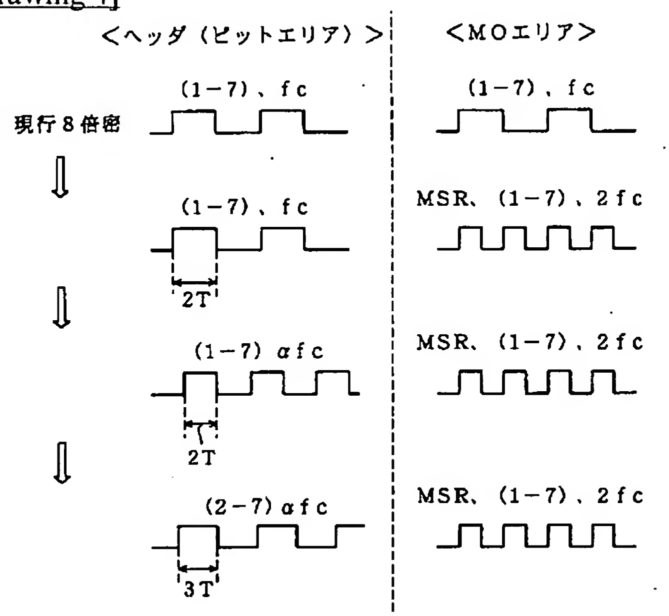
[Drawing 3]

(a)

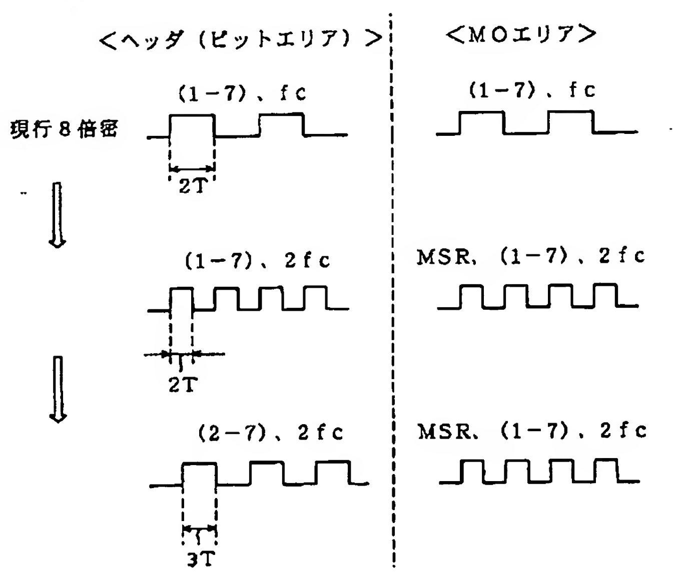
(b)



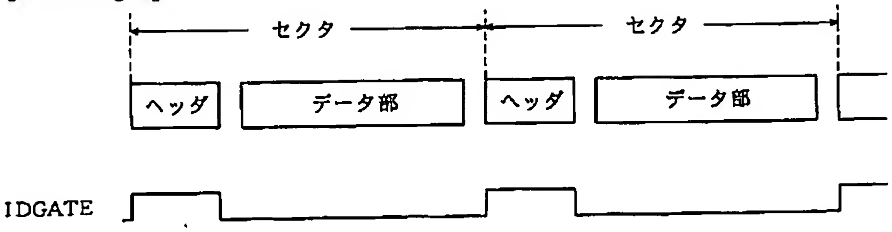
[Drawing 4]



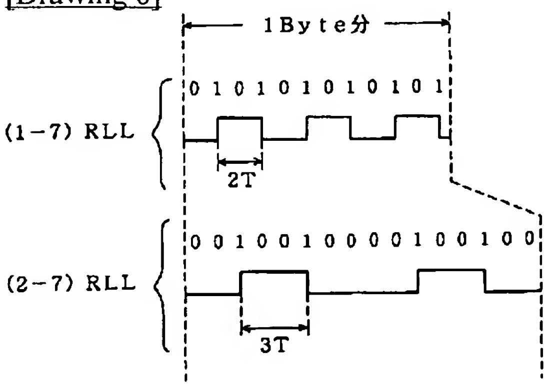
[Drawing 5]



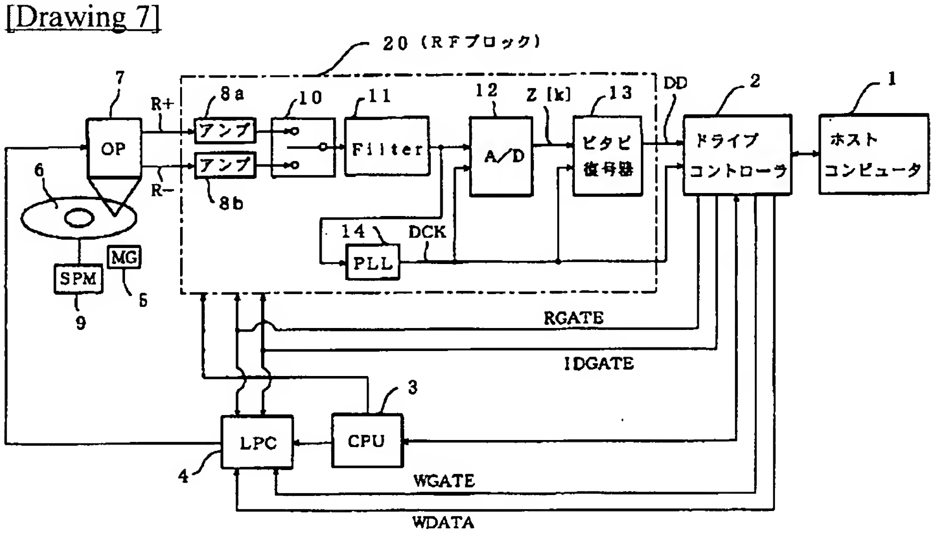
[Drawing 9]



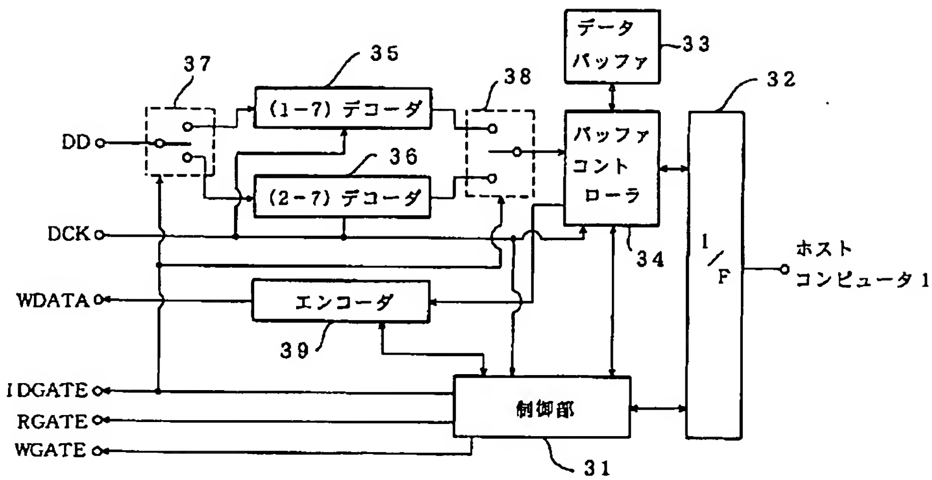
[Drawing 6]



[Drawing 7]



[Drawing 8]



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[Translation done.]